

MIL-T-83133A
18 May 1979
SUPERSEDING
MIL-T-83133
5 May 1976

MILITARY SPECIFICATION

TURBINE FUEL, AVIATION, KEROSENE TYPE, GRADE JP-8

This specification is approved for use by all Departments
and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers one grade of aviation turbine fuel.

<u>Grade</u>	<u>NATO Code No.</u>	<u>Description</u>
JP-8	F-34	Kerosene type similiar to ASTM Jet A-1 fuel

2. APPLICABLE DOCUMENTS

2.1 Issues of documents. The following documents, of the issue in effect on
date of invitation for bids or request for proposal, form a part of this
specification to the extent specified herein.

SPECIFICATIONS

Military

MIL-I-25017 Inhibitor, Corrosion, Fuel Soluble
MIL-I-27686 Inhibitor, Icing Fuel System

STANDARDS

Federal

FED-STD-791 Lubricants, Liquid Fuels, and Related Products; Methods of
Testing

Military

MIL-STD-105 Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-290 Packaging, Packing and Marking of Petroleum and Related
Products

Beneficial comments (recommendations, additions, deletions) and any
pertinent data which may be of use in improving this document should
be addressed to: ASD/ENESS, Wright-Patterson AFB, OH 45433 by using
the self-addressed Standardization Document Improvement Proposal
(DD Form 1426) appearing at the end of this document or by letter.

ASTM D 56	Test for Flash Point by Tag Closely Tester	ASTM D 86	Distillation of Petroleum Products, Method For Flash Point By Pensky-Martens Closed Tester	ASTM D 93	Detection of Copper Corrosion Test, Method For	ASTM D 130	Detection of Copper Corrosion Test, Method For	ASTM D 156	Saybolt Color of Petroleum Products (Saybolt Chromometer)	ASTM D 270	Sampling Petroleum and Petroleum Products	ASTM D 381	Test for Existence of Gum in Fuels by Jet Evaporation	ASTM D 445	Kinematic Viscosity of Transformer Oil and Oils (And the Calibration of Dynamical Viscosities)	ASTM D 484	Hydrocarbon Dry Cleaning Solvents (Doctor Test)	ASTM D 1018	Test for Hydrogen in Petroleum Fractions	ASTM D 1266	Test for Density, Specific Gravity, or API Gravity of Crude Petroleum and Liquified Petroleum Products by Hydrometer Method	ASTM D 1322	Fluorescent Indicator Absorption	ASTM D 1655	Aviation Turbine Fuels, Standard Specification For	ASTM D 2276	Tests for Particulate Contaminant in Aviation Turbine Fuels	ASTM D 2382	Test for Heat of Combustion of Hydrocarbon Fuels by Bomb	ASTM D 2386	Calorimeter (High-Precision Method)	ASTM D 2550	Test for Freezing Point of Aviation Fuels	ASTM D 2622	Fuels	ASTM D 2624	Test for Electrical Conductivity of Aviation Turbine Fuels	ASTM D 2887	Gas Chromatography	ASTM D 3114	Test for DC Electrical Conductivity of Hydrocarbon Fuels	ASTM D 3227	Turbine and Distillate Fuels (Potentiometric Method)
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American Society for Testing and Materials Standards

2.2 Other Publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

apply.

(Copies of specifications, standards, drawings, and publications required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

QPL-25017 Inhibitor, Corrosion, Fuel Soluble

Qualified Products Lists

PUBLICATION

MIL-T-8313A

- ASTM D 3241 Test for Thermal Oxidation Stability of Aviation Turbine Fuels (JFTOT Procedure)
 ASTM D 3242 Test for Total Acidity in Aviation Turbine Fuel
 ASTM D 3243 Test for Flash Point of Aviation Turbine Fuels by Setaflash
 Closed Tester
 ASTM D 3338 Heat of Combustion of Aviation Fuels, Estimation of
 ASTM D 3343 Method for Estimation of Hydrogen Content of Aviation Fuels
 ASTM D 3701 Hydrogen Content of Aviation Turbine Fuels by Low Resolution Nuclear Magnetic Resonance Spectrometry
 ASTM E 29 Recommended Practices for Indicating Which Places of Figures are to be Considered Significant in Specified Limiting Values

(Copies of these standards may be obtained from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

Department of Transportation

- 49 CFR 170-189 Department of Transportation Rules and Regulations for the Transportation of Explosives and Dangerous Articles

(Copies of these documents may be obtained from the Superintendent of Documents, U. S. Government Printing Office, Washington, DC 20402.)

3. REQUIREMENT

3.1 Materials. Except as otherwise specified herein, the fuel shall consist completely of hydrocarbon compounds.

3.2 Chemical and physical requirements. The chemical and physical requirements of the finished fuel shall conform to those listed in table 1. Requirements contained herein are not subject to corrections for test tolerances. If multiple determinations are made, results falling within any specified repeatability and reproducibility tolerances may be averaged. For rounding off of significant figures, ASTM E 29 (as referenced in ASTM D 381) shall apply to all tests required by this specification.

3.3 Additives. The type and amount of each additive used shall be reported (see 6.2.1).

3.3.1 Antioxidants. Immediately after processing, add an approved antioxidant in order to prevent the formation of gums and peroxides after manufacture. The concentration of antioxidant to be added shall be:

- a. Not less than 6.0 pounds nor more than 8.4 pounds of active ingredient per 1,000 barrels of fuel (17.2 to 24.0 mg/l) to all JP-8 fuel that contains blending stocks that have been hydrogen treated.
- b. At the option of the supplier, not more than 8.4 pounds of active ingredient per 1,000 barrels of fuel (24.0 mg/l) may be added to JP-8 fuels that do not contain hydrogen treated blending stocks.

Property	Min	Max	ASTM Standards
Color, Saybolt		1/ 0.015	D 156
Total Acid Number, mg KOH/gm	25.0		D 3242
Aromatics, vol percent			D 1319
Olefins, vol percent		5.0	D 1319
Sulfur, Mercaptan, wt percent 2/	0.001		D 3227
Sulfur, total, wt percent	0.3		D 1266, D 2622
Distillation Temperature, °C 3/			D 86, D 2887
(D 2887 limits given in parentheses)			
Initial boiling point		1/ 205 (186)	
10 percent recovered		1/ 1/	
20 percent recovered		1/ 300 (330)	
50 percent recovered		1/ 1.5	
90 percent recovered		1.5	
End point			
Residue, vol percent			
Loss, vol percent			
Flash point, °C (°F)	38 (100)		D 56, D 93, D 3243 10/
Gravity, deg API or	37		D 1298
Density, kg/l at 15°C	0.775		D 1298
Freezing point, °C (°F)			
Viscosity, at -20°C, centistokes		-50 (-58)	D 2386
Net heat of combustion, MJ/kg (Btu/lb)	42.8 (18,400)	8.0	D 445 D 240, D 2382, D 3338 4/
Combustion			
(1) Hydrogen content, wt percent or	13.5		D 1018, D 3343, D 3701 5/
(2) Smoke point, mm or	19		D 1322
Copper strip corrosion, 2 hr at 100°C (212°F)	No. 1b		D 130
Thermal stability change in pressure drop, mm Hg heater tube deposit visual rating		25 less than Code 3	D 3241 6/ D 3241 6/ D 3241 6/
Existent gum, mg/100 ml	7.0		D 381
Particulate matter, mg/liter	1.0		D 2276 7/ D 1094
Water reaction	1b		
Interface rating			
Water separation index, modified			D 2550
Fuel system icing inhibitor, vol percent	0.10	0.15	8/ D 2624 or D 3114
Fuel electrical conductivity, p/Sm 11/	200	600	

Table I. Chemical and physical requirements and test methods. (Continued)

- 1/ To be reported - not limited.
- 2/ The mercaptan sulfur determination may be waived at the option of the inspector if the fuel is "doctor sweet" when tested in accordance with the doctor test of ASTM D 484.
- 3/ A condenser temperature of 0° to 40°C (32° to 40°F) shall be used for the distillation by D 86. Distillation shall not be corrected to 760 mm pressure.

- 4/ When the fuel distillation test is performed using ASTM D 2887, the average distillation temperature, for use in ASTM D 3388 shall be calculated as follows:

$$V = \frac{10\% + 50\% + 95\%}{3}$$

- 5/ When the fuel distillation test is performed using ASTM D 2887, the average distillation temperature, for use in ASTM D 3343, shall be calculated as follows:

$$V = \frac{10\% + 50\% + 95\%}{3}$$

- 6/ See 4.7.1.1 for D 3241 test conditions and test limits.

- 7/ A minimum sample size of one gallon shall be filtered.

- 8/ Test shall be performed with method 5327, 5330, or 5340 of FED-STD-791.

- 9/ The minimum water separation index, modified, rating for JP-8 shall be 85 with all additives except the corrosion inhibitor and the electrical conductivity additive or 70 with all additives except the electrical conductivity additive.

- 10/ ASTM D3243 shall be the referee method. Note that D 56 may give results 1.7°C(30°F) above D 3243 results, and D93 may give results 2.7°C(5°F) above D 3243 results.

- 11/ The conductivity must be in the range of 200 to 600 pS/m at ambient fuel temperature or 85°F, whichever is lower.

not exceed the maximum allowable concentration listed in the latest revision of MIL-I-25017 shall be equal to or greater than the minimum effective concentration and shall shall be blended into the JP-8 grade fuel by the contractor. The amount added 3.3.4 Corrosion inhibitor. A corrosion inhibitor conforming to MIL-I-25017

a. ASA-3 marketed by Shell Chemical Company, Houston, TX.

3.3.3 Electrical conductivity additive is approved:
The point of injection of the additive shall be determined by agreement between the purchasing authority and the supplier. The following electrical conductivity additive is approved:
Fuel in sufficient concentration to increase the conductivity of the fuel to within the range of 200 to 600 picocuries per meter at the point of injection.

3.3.2 Metal deactivator. A metal deactivator, N,N'-diisalicylidene-1,2-propandiamine or N,N'-diisalicylidene-1,2-ge洛hexanediamine may be blended into the fuel in an amount not to exceed two pounds active ingredient per 1,000 barrels of fuel (22 mg/gal (US), 26 mg/gal (UK), or 5.8 mg/liter).

1. 55 percent min butylated ethyl phenols
45 percent max butylated methyl and dimethyl phenols

2. 35 percent max mixture of other isopropylphenols and biphenols
65 percent min mixture of 2,4,5-trisopropylphenol and 2,4,6-trisopropylphenol

3. 30 percent min mixture of 2,3,6-trimethylphenol and 2,4,6-trimethylphenol
70 percent max mixture of dimethylphenols

4. 60 percent min 2,4-di-tert-butylphenol
40 percent max mixture of tert-butylphenols

5. 35 percent min 2,6-di-tert-butyl-4-methylphenol
65 percent max mixture of methyl-, ethyl-, and dimethyl-tert-butylphenols

6. 60 to 80 percent 2,6-diaklyphenols
20 to 40 percent mixture of 2,3,6-trialkylphenols and 2,4,6-trialkylphenols

7. 45 percent max mixture of tert-butylphenols and di-tert-butylphenols
55 percent min 6-tert-butyl-2,4-dimethylphenol

8. 28 percent max tertbutyl-methylphenols and tert-butyl-dimethylphenols
72 percent min 6-tert-butyl-2,4-dimethylphenol

9. 25 percent max tert-butylphenols and tri-tert-butylphenols
75 percent min 2,6-di-tert-butylphenol

10. 2,6-di-tert-butylphenol

b. 6-tert-butyl-2,4-dimethylphenol

a. 2,6-di-tert-butyl-4-methylphenol

3.3.1.1 The following antioxidant formulations are approved:

QPL-25017. The contractor or the transporting agency, or both, shall maintain and upon request make available to the Government evidence that the corrosion inhibitors are equal in every respect to the qualified products listed in QPL-25017.

3.3.5 Fuel system icing inhibitor. The fuel system icing inhibitor shall be mandatory and shall conform to MIL-I-2768. The point of injection of the additive shall be determined by agreement between the purchasing authority and the supplier.

3.4 Workmanship. The finished fuel shall be visually free from undissolved water, sediment, or suspended matter and shall be clean and bright at the ambient temperature or at 21°C (70°F), whichever is higher.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, the contractor may use his own or any other facilities suitable for performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Quality conformance inspection. For acceptance purposes, individual lots shall be examined as specified herein and subject to tests for all requirements cited in section 3.

4.3 Inspection lot

4.3.1 Bulk lot. A bulk lot shall consist of an indefinite quantity of a homogeneous mixture of material offered for acceptance in a single isolated container.

4.3.2 Packaged lot. A packaged lot shall consist of an indefinite number of 55-gallon drums or small unit packages of identical size and shape offered for acceptance and filled from the isolated tank containing a homogeneous mixture of material.

4.4 Sampling

4.4.1 Sampling for verification of product quality. Each bulk or packaged lot of material shall be sampled for verification of product quality in accordance with ASTM D 270, except where individual test procedures contain specific sampling instructions.

4.4.2 Sampling for examination of filled containers for delivery. A random sample of filled containers shall be selected from each lot in accordance with MIL-STD-105 at inspection level II and acceptable quality level (AQL) of 2.5 percent defective. The samples shall be examined in accordance with 4.6.3.

4.5 Inspection. Inspection shall be performed in accordance with method 9601 of FED-STD-791.

- a. Differential pressure in millimeters of mercury at 150 minutes, or time to differentiate visual rating of 25 millimeters of mercury, whichever comes first.
- b. Heater tube deposit visual rating code at the end of the test.
- c. If a Mark 8A tube deposit rate (TDR) is available, the maximum SPUN TDR rating shall be reported.

4.7.1.1.3 ASTM D 3241 reported data. The following data shall be reported:

- a. Differential pressure in millimeters of mercury at 150 minutes, or time to differentiate visual rating of 25 millimeters of mercury, whichever comes first.
- b. The maximum visual rating of the heater tube deposits is less than a code millimeters of mercury.
- c. The maximum differential pressure across the test filter does not exceed 25 millimeters of mercury.

4.7.1.1.2 Results. The fuel sample is acceptable if all the following criteria are met:

- a. Heater tube temperature at maximum point: 260°C (500°F)
- b. Fuel system pressure: 3.45 MPa (500 psig)
- c. Fuel flow rate: 3.0 mL/minute
- d. Test duration: 150 minutes

4.7.1.1.1 ASTM D 3241 test conditions

4.7.1.1 ASTM D 3241. The thermal stability test shall be conducted using ASTM D 3241 (JFTOT). The heater tube shall be rated visually (see Appendix A).

4.7.1 Thermal stability

4.7 Test methods. Tests to determine conformance to chemical and physical requirements shall be conducted in accordance with MIL-STD-791 or ASTM standards, using the applicable methods as listed in Table I, except for the following.

4.6.3 Examination of filled containers. Samples taken as specified in 4.4.2 shall be examined for conformance to MIL-STD-290 with regard to fill, closure, sealing, leakage, packaging, and markings. Any container having one defect or more defects under the required fill shall be rejected. If the number of defects under the required fill exceeds the acceptance number for the appropriate plan of MIL-STD-105, the lot represented by the sample shall be rejected.

4.6.2 Examination of empty containers. Prior to filling, each empty unit containing shall be visually inspected for cleanliness and suitability.

4.6.1 Examination of product. Samples selected in accordance with 4.4.1 shall be visually examined for compliance with 3.4.

4.6 Examinations

4.8 Test report. Test data required by 4.7 shall be reported in accordance with ASTM D 1655, using the standard ASTM form entitled "Inspection Data on Aviation Turbine Fuels" or AF TO Form 476 (see 6.2.1).

5. PACKAGING

5.1 Packaging, packing, and marking. Packaging, packing, and marking shall be in accordance with MIL-STD-290. All fuel containers shall be marked with the actual flash point in °F of the fuel contained therein.

5.2 Transportation of fuels. The transportation of the JP-8 fuel shall be in accordance with the Department of Transportation Rules and Regulations (see 2.2).

6. NOTES

6.1 Intended use. The fuel covered by this specification is intended for use in aircraft turbine engines.

6.2 Ordering data. Procurement documents should specify:

- a. Title, number, and date of this specification
- b. Quantity required and size containers desired
- c. Level of packaging and packing required (see 5.1).
- d. Location and injection method for addition of full system icing inhibitor and electrical conductivity additive.

6.2.1 Contract data requirements. Data specified in 3.3 and 4.8 will be listed directly on a DD Form 1423 and incorporated into the contract.

6.3 Precaution of mixing additives. To prevent any possible reaction between the concentrated forms of different additives (see 3.3), the fuel contractor is cautioned not to commingle additives prior to their addition to the fuels.

6.4 International agreements. Certain provisions of this specification are the subject of international standardization agreement ASCC 15/1 - STANAG 1135. When amendment, revision, or cancellation of this specification is proposed which affects or violates the international agreement concerned, the preparing activity will take appropriate reconciliation action through international standardization channels including departmental standardization offices, if required.

Custodians:

Army - MR
Navy - AS
Air Force - 11

Preparing activity:

Air Force - 11

Project No. 9130-0094

Review activities:

Army - MI, AV
Air Force - 68

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APPENDIX A

HEATER TUBE DEPOSIT RATING

10. Visual method

10.1 Snap the upper end of the heater tube into the clamp of the adapter for the heater tube.

10.2 Push the heater tube against the stop of the adapter tube.

10.3 Slide the adapter with the heater tube over the guide rod into the tuberator equipped with a magnifying glass assembly.

10.4 Insert the ASTM color standard into the tuberator.

10.5 Rotate the adapter and position the heater tube so that the side with the maximum deposit is visible.

10.6 Within 30 minutes after completion of the test, visually examine the heater tube in a tuberator. The entire portion of the test section between the bottom shoulder and the top shoulder of the heater tube shall be carefully examined using a magnifying glass in conjunction with the tuberator for any signs of discoloration, scratches, or other visually identified defects. When an area of the tube corresponds visually to an ASTM color standard, that color standard code number shall be recorded. If the area being rated has a color between two adjacent color standards, it shall be rated as the lighter (that is lower number) color standard. (NOTE: It is important that all light bulbs in the Tuberator are functioning as a change in light intensity can shift the rating significantly.) (NOTE: The person rating the tube should have normal ability to distinguish between colors; i.e., he should not be color blind.)

10.6.1 In rating the heater, tube the darkest deposits govern and the code number representative of the darkest section, rather than the average deposit shall be reported.

10.6.2 If a spot or streak is found on the heater tube, it shall be carefully examined under various lighting conditions using a magnifying glass to determine if it is a deposit, a scratch, or tube defect (Note that the tube defects should have been found during the pretest inspection of the tube.) If the spot or streak is determined to be a scratch or tube defect, it shall be disregarded. If the spot or streak is a deposit, it shall be rated against the ASTM color standards, if larger in area than about 0.004 square inch (0.025 sq cm); i.e., approximately 1/16 inch x 1/16 inch (1.5 mm x 1.5 mm) square or an equivalent area. However, a streak deposit shall be ignored if less than 1/32 inch (0.8 mm) wide, regardless of length. Note the the tube section is 1/8 inch (about 3 mm) in diameter; thus a 1/16 inch (1.5 mm) wide spot is 1/2 the diameter of the tube test section and 1/32 inch (0.8 mm) wide streak is 1/4 the diameter of the tube test section.

10.6.3 If the heater tube has deposits which do not match the color standards, the folowing criteria shall be used:

10.6.3.1 If the deposit has peacock (rainbow) colors, rate this as code P (P for peacock). If some portion of the deposit does match the color standard, it shall be rated.

10.6.3.2 Deposits having abnormal colors (for example, blue or gray) shall have a rating of code A (A for abnormal color) assigned.

10.6.3.3 When reporting the overall tube rating, record the rating of the maximum deposit which matches the color standards plus P or A if the tube contains deposits which do not match the color standards. If the tube contains deposits which do not match the color standards, it is to be used as follows:

Example 1 - The darkest deposits on the heater tube match color standard 3. Also present are peacock colors. Thus, the overall tube rating to be reported is 3P.

Example 2 - The heater tube has maximum deposits falling between color standards 2 and 3 and has no peacock or abnormal colors. The total tube rating is 2.

Example 3 - The heater tube matches color standard 1 except for an abnormal deposit which does not match the ASTM color standards. The overall tube rating to be reported is 1A.

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

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